APPENDIX E: Dichotomous Key to the Plant Associations of ZION

(Produced by NatureServe 2001 Western Regional Office (Marion Reid and Keith Schulz)

DICHOTOMOUS KEY TO THE PLANT ASSOCIATIONS OF ZION NATIONAL PARK

Plant names in Latin and follow the nomenclature of Kartesz (1999).

1a. Non-forested Plant Associations. Shrub or herbaceous plant species have greater cover than trees. Tree canopy cover is typically less than 25%. However, canopy cover for *Pinus edulis, Pinus monophylla, Pinus ponderosa*, and *Juniperus osteosperma* may be less, as low as 20%, and the stand still be considered a forest or woodland plant association occurring in particularly dry climate conditions. (See **Forest and Woodland Vegetation).**

2a. Sparsely Vegetated Plant Associations: Cover of vascular plant species is minimal, usually less than 10%, but may exceed 20% in some stands with characteristic substrates. The substrate is the dominant feature. Examples of substrates nearly barren of vegetation are sandstone (slickrock), Chinle badlands, lichen crusts, and shale rock fragments ..... **Key A**
2b. Shrublands and Grasslands: Cover of vascular plant species is greater than 10%. Vegetation is dominated by either shrubs or herbaceous forbs and grass-like plants..... **3a -3b**

3a. Shrub layer dominates over other stratums with heights to 3 meters **(Shrublands)**..... **4a -4b**
3b. Herbaceous species dominate ..... **7a -7b**

4a. Shrub heights are less than ½ meter (**Dwarf-shrublands**) .....**Key B**
4b. Shrub heights are ½ meter to 3 meters.....**5a – 5b**

5a. Palustrine environments, seasonally, temporarily, or permanently saturated soils ..... **Key C**
5b. Upland environments.....**6a – 6b**

6a. Upland environments occurring below 4500 feet in elevation, southern and southwestern region of Zion National Park ..... **Key D**
6b. Upland environments, occurring above 4500 feet in elevation .....**Key E**

7a. Graminoids (grasses and grass-like plants) dominate woodland or forest openings and rocky outcrops; upland environments.....**Key F**
7b. Graminoids dominate in non-upland (palustrine) environments ..... **Key G**

1b. Forest and Woodland Plant Associations. Greater than 25% tree canopy cover for *Abies concolor, Acer grandidentatum, Acer negundo, Fraxinus anomala, Populus fremontii, Populus tremuloides*, and *Pseudotsuga menziesii.* Canopy cover for *Pinus edulis, Pinus monophylla, Pinus ponderosa*, and *Juniperus osteosperma* may be less, as low as 20% and still be considered a forest or woodland plant association occurring in particularly dry climate conditions ..... **2a -2b**

2a. Pines or Junipers dominate the tree canopy layer, dominant tree species include *Pinus edulis, Pinus monophylla, Pinus ponderosa,* and *Juniperus osteosperma*..... **Key H**
2b. Other conifers or deciduous trees dominate the tree canopy .....**3a – 3b**

3a. Douglas-fir or white fir dominate the tree canopy layer, *Pseudotsuga menziesii* and *Abies concolor*.....**Key I**
3b. Deciduous trees dominate the tree canopy; riparian ecosystems or cool and relatively mesic environmental conditions, such as higher elevations, north-facing ravines and canyons. Dominant species include *Populus fremontii, Populus angustifolia, Fraxinus velutina, F. anomala, Acer negundo, Acer grandidentatum*, or *Populus tremuloides*..... **Key J**

Key A: Sparse Vegetation

1 Substrate is Navaho sandstone Formation, "slickrock".

2 *Pinus ponderosa* is present, with only 5-20% cover and usually stunted growth, heights average less than 10 meters. *Arctostaphylos patula, Cercocarpus intricatus, Quercus turbinella and Amelanchier utahensis* are usually present in some combination in the shrub layer distributed sparsely across Navaho sandstone "slickrock" slopes. ..... ***Pinus ponderosa* Slickrock Sparse Vegetation**

2 *Pinus ponderosa* is absent or has less than 5% cover and heights less than 5 meters. *Cercocarpus intricatus* dominates the shrub layer. Other shrubs commonly present are *Arctostaphylos patula, Amelanchier utahensis,* and *Quercus turbinella.* Total shrub cover is less than 20%. Sandstone slopes are generally steep..... ***Cercocarpus intricatus* Slickrock Sparse Vegetation**

1 Substrate is not Navajo sandstone.

3 Substrate is shale rock fragments. *Cercocarpus montanus* dominates the shrub layer with few other shrubs present. Only known to occur in the northern region of the Park on mesa rims or mountain ridges..... ***Cercocarpus montanus* Rock Pavement Sparse Vegetation**

3 Substrate is not shale rock fragments.

4 Substrate is Chinle Formation. *Gutierrezia sarothrae* and *Eriogonum corymbosum* codominate the dwarf-shrub layer with less than 20% cover. Other species commonly present contributing minimal cover are *Atriplex canescens, Ericameria nauseosa, Psorothamnus fremontii, Purshia stansburiana* and/or *Coleogyne ramosissima.* Graminoid *Pleuraphis jamesii* is commonly present. ..... ***Eriogonum corymbosum* Badlands Sparse Vegetation**

4 *Ephedra nevadensis* dominates the shrub layer, but may have less than 5% cover. Cryptogamic crust contributes up to nearly 90% ground cover and usually occurs on Chinle Formation. ..... ***Ephedra nevadensis* / Lichen Sparse Vegetation [Provisional]**

Key B: Dwarf-shrublands

1 *Gutierrezia sarothrae* dominates the dwarf-shrub layer, but may only have 10% cover. *Opuntia* spp. is frequently present. Graminoid *Pleuraphis jamesii* is present and may exceed the cover of *Gutierrezia sarothrae.* ....***Gutierrezia sarothrae – (Opuntia spp.) / Pleuraphis jamesii* Dwarf-shrubland**

1 *Artemisia nova* is the dominant shrub with greater than 10% cover. (Always occurring above 6000 feet.)

2 *Hesperostipa comata* dominates the herbaceous layer. Other graminoids may be present with less cover. ..... ***Artemisia nova / Hesperostipa comata* Dwarf-shrubland.**

2 *Hesperostipa comata* does not dominate the herbaceous layer.

3 *Poa fendleriana* dominates the herbaceous layer. Other graminoids may be present with less cover. ..... ***Artemisia nova / Poa fendleriana*** **Dwarf-shrubland [Provisional]**

3 *Poa fendleriana* does not dominate the herbaceous layer.

4 *Elymus elymoides* dominates the herbaceous layer and may codominate with *Poa secunda*, *Bouteloua gracilis, Koeleria macrantha,* or other graminoid species. .... ***Artemisia nova / Elymus elymoides*** **Dwarf-shrubland**

Key C: Palustrine Shrublands

1 Shrub dominated riparian, intermittent stream (washes) or wet meadow vegetation occupying all elevations in the Park. *Salix* species dominate the shrub layer.

2 *Salix exigua* dominates the shrub layer.

3 *Salix exigua* cover is 10 to 30%. Herbaceous layer cover is less than 10%. .... ***Salix exigua /*** **Barren Shrubland**

3 *Salix exigua* cover is over 20% with a lush, mesic graminoid understory .... ***Salix exigua /*** **Mesic Graminoids Shrubland**

2 *Salix ligulifolia* dominates the shrub layer. This association occurs in high-elevation (above 7000 feet) willow carrs with diverse and lush herbaceous understory that typically includes *Carex utriculata, Carex rostrata, Poa pratensis, Agrostis stolonifera, Phleum pratensis, Carex microptera, Maianthemum stellatum,* and other mesic herbaceous species. .... ***Salix ligulifolia / Carex utriculata*** **Shrubland [Provisional]**

1 *Salix* species do not dominate the riparian shrub layer.

4 *Pluchea sericea* dominates the shrub layer. Herbaceous cover is minimal. .... ***Pluchea sericea*** **Shrubland [Placeholder]**

4 *Pluchea sericea* is not present.

5 *Baccharis emoryi* dominates shrubland. ..... ***Baccharis emoryi*** **Shrubland [Provisional]**

5 *Betula occidentalis* is present in the understory. Canopy species include *Populus fremontii, Populus angustifolia, Fraxinus velutina, Acer negundo*, *Pinus ponderosa* and *Juniperus scopulorum*. Tree canopy typically minimal, trees are young and included in tall shrub layer. *Acer grandidentatum* and *Quercus gambelii* are often present in the shrub layer. .... ***Populus fremontii / Betula occidentalis*** **Wooded Shrubland**

Key D: Shrublands below 4500 feet elevation

1 *Coleogyne ramosissima* dominates the shrub layer.

2 Shrubs, *Atriplex canescens, Ephedra* spp., and *Gutierrezia* spp. are commonly present, but contribute less cover than *Coleogyne ramosissima*. Graminoid, *Pleuraphis jamesii,* is absent or has less than 10% cover. ..... ***Coleogyne ramosissima* Shrubland**.

2 Herbaceous layer is well represented by graminoid *Pleuraphis jamesii*, at least 10% cover. ..... ***Coleogyne ramosissima / Pleuraphis jamesii* Shrubland**

1 *Coleogyne ramosissima* is not the dominant shrub.

3 *Artemisia filifolia* dominates the shrub layer and is often associated with graminoid *Sporobolus cryptandrus.*..... ***Artemisia filifolia* Colorado Plateau Shrubland**

3 *Artemisia filifolia* is not the dominant shrub.

4 *Ephedra nevadensis* dominates the shrub layer on volcanic rock substrate. .... ***Ephedra nevadensis* Basalt Shrubland [Provisional]**

4 *Ephedra nevadensis* does not dominate.

5 *Ericameria nauseosa* dominates shrub layer on alluvial flats. *Rhus trilobata* is absent to well represented. *Artemisia tridentata* may be present. *Bromus tectorum* and other exotic herbaceous species are a major component of the herbaceous layer. May also occur above 4500 feet..... ***Ericameria nauseosa / Bromus tectorum* Semi-natural Shrubland**

5 *Ericameria nauseosa* does not dominate shrub layer.

6 *Atriplex canescens* and *Artemisia tridentata* ssp. *tridentata* codominate, each with only 5-10% cover. Other shrubs commonly present are *Ephedra nevadensis, Ericameria nauseosa, Chrysothamnus viscidiflorus,* and *Gutierrezia microcephala.* ..... ***Atriplex canescens – Artemisia tridentata* Shrubland**

6 *Atriplex canescens* dominates shrubland with 10 to 30% cover. *Artemisia tridentata* is not present. Other shrubs commonly present are *Lycium pallidum, Psorothamnus fremontii, Ephedra nevadensis,* and *Gutierrezia sarothrae.* Herbaceous layer has dense cover of exotic species..... ***Atriplex canescens* Shrubland**

Key E: Shrublands above 4500 feet elevation

1 *Quercus gambelii* dominates or is codominant in the shrub layer. Cover ranges from 10 to 100%. Physiognomic form may be tree (over 10 cm DBH), tall shrub or short shrub.

2 *Artemisia tridentata* is codominant with cover of 10% to 40%. Other shrubs commonly present are *Tetradymia canescens, Ericameria nauseosa, Purshia tridentata,* and *Chrysothamnus viscidiflorus.* The co-dominants are distributed as a relatively uniform, fine-scaled mosaic of *Quercus gambelii* clumps in extensive stands of *Artemisia tridentata.*..... ..... ***Quercus gambelii / Artemisia tridentata* Shrubland**

2 *Artemisia tridentata* does not codominate with *Quercus gambelii*.

3 *Cercocarpus montanus* is present with 10 to 50% cover. Other shrubs commonly present, with substantial cover, are *Amelanchier utahensis, Quercus turbinella, Arctostaphylos patula,* and *Peraphyllum ramosissima*..... ***Quercus gambelii – Cercocarpus montanus* / (*Carex geyeri*) Shrubland**

3 *Cercocarpus montanus* is absent or has less than 10% cover.

4 *Amelanchier utahensis* is codominant in the stand with cover ranging 10 to 50% and occasionally exceeding cover of *Quercus gambelii. Cercocarpus montanus* is either absent or has minimal cover.....***Quercus gambelii / Amelanchier utahensis* Shrubland**

4 *Amelanchier utahensis* does not codominate.

5 *Quercus gambelii* dominates the stand as a tall shrub, 1 to 3 meters high, and can be tree size in some cases. *Symphoricarpos oreophilus* dominates the shrub layer under *Quercus gambelii.* Cover must be over 5%. The herbaceous layer may be significant. *Poa fendleriana* cover is less than 5%. ..... ***Quercus gambelii / Symphoricarpos oreophilus* Shrubland**

5 *Symphoricarpos oreophilus* has less than 5% cover in the understory or less cover than *Poa fendleriana*..... ***Quercus gambelii / Poa fendleriana* Shrubland [Provisional]**

1 *Quercus gambelii* does not dominate the shrub layer.

6 *Arctostaphylos patula* dominates or is codominant in the shrub layer.

7 *Quercus gambelii* is codominant in the shrub layer in a mosaic pattern with *Arctostaphylos patula*. This association usually occurs on high mesas or plateaus. Other shrubs may be present, but have minimal cover..... ***Arctostaphylos patula – Quercus gambelii – (Amelanchier utahensis)* Shrubland**

7 *Quercus gambelii* does not codominate.

8 *Arctostaphylos patula* has cover of 10 to 100%. *Pinus ponderosa, Juniperus osteosperma, Pinus monophylla,* or *Pinus edulis* may be present but have less than 10% cover. This association mostly occurs on sandy slickrock basins, benches, and mesas. *Arctostaphylos patula* occurs alone or in a shrub mix. *Cercocarpus intricatus, Amelanchier utahensis, Quercus turbinella* may be well represented in the mix. *Quercus gambelii,* if present, is poorly represented.....***Arctostaphylos patula* Shrubland**

8 *Artemisia tridentata* ssp. *vaseyana* codominates the shrub layer. Other shrubs that may be present and even with significant cover are *Quercus gambelii* and *Tetradymia canescens.* Presence of *A. tridentata ssp. vaseyana* with *Arctostaphylos patula* identifies this association.....***Arctostaphylos patula – Artemisia tridentata ssp. vaseyana* Shrubland**

6 *Arctostaphylos patula* does not dominate.

9 *Artemisia tridentata* dominates the shrub layer.

10 *Tetradymia canescens* is usually co-dominant with *Artemisia tridentata* or at least present. *Bouteloua gracilis* dominates the herbaceous layer with 10% cover or more. ....***Artemisia tridentata / Bouteloua gracilis*** **Shrubland**

10 *Bouteloua gracilis* is not dominant in the herbaceous understory.

11 *Hesperostipa comata* is present to abundant in the herbaceous layer and occurs with *Artemisia tridentata* ssp. *vaseyana* at elevations above 6000 feet. This association occurs amongst *Quercus gambelii* and *Pinus edulis – Juniperus osteosperma* woodlands. Other graminoid species commonly present are *Bouteloua gracilis, Poa fendleriana,* and *Muhlenbergia* spp. ....***Artemisia tridentata*** **ssp.** ***vaseyana / Hesperostipa comata*** **Shrubland**

11 *Hesperostipa comata* does not dominate the herbaceous layer.

12 *Pascopyrum smithii* or *Elymus lanceolatus* dominates the herbaceous layer. This association has only been documented on the western side of the Park in Lee Valley. …***Artemisia tridentata*** **ssp.** ***tridentata / Pascopyrum smithii - (Elymus lanceolatus)*** **Shrubland**

12 *Bromus tectorum* dominates the herbaceous understory of this *Artemisia tridentata* shrubland. *Ericameria nauseosa* has 0 to 30% cover. This association is likely to be found in highly disturbed areas..... .....***Artemisia tridentata – (Ericameria nauseosa) / Bromus tectorum*** **Semi-natural Shrubland**

9 *Artemisia tridentata* does not dominate.

13 *Arctostaphylos pungens* dominates the shrub layer or has at least 10% cover. Other species present may be *Arctostaphylos patula, Amelanchier utahensis, Quercus gambelii*, and *Ceanothus fendleri*. This association is uncommon in Zion NP and is most commonly found in the Kolob Canyons region.....***Arctostaphylos pungens*** **Shrubland**

13 *Arctostaphylos pungens* is not dominant.

14 *Quercus turbinella* dominates the shrub layer with 10 to 70% cover. Other shrubs that may be present are *Amelanchier utahensis, Arctostaphylos patula, Arctostaphylos pungens, Shepherdia rotundifolia, Fraxinus anomala, Rhus trilobata,* and *Quercus gambelii.* This shrubland is composed of various combinations of these species. Environmental conditions are significant in that this association occurs on 20^{o} to 40^{o} colluvial slopes below sandstone walls or on gentle slopes at the base of colluvial slopes throughout the Park..... .....***Quercus turbinella – (Amelanchier utahensis)*** **Colluvial Shrubland**

14 *Quercus turbinella* does not dominate.

15 *Amelanchier utahensis* clearly dominates this association with 10 to 50% cover. *Artemisia tridentata* has been documented to occur and sometimes codominate with *Amelanchier utahensis* in Cave Valley. In most cases other shrubs are absent or insignificant. .....***Amelanchier utahensis* Shrubland**

15 *Amelanchier utahensis* does not dominate

16 *Symphoricarpos oreophilus* dominates the shrub layer with an understory dominated by *Poa pratensis.* ....***Symphoricarpos oreophilus / Poa pratensis* Semi-natural Shrubland [Provisional]**

16 *Symphoricarpos oreophilus* does not dominate.

17 *Chrysothamnus viscidiflorus* dominates the shrub layer with an understory dominated by *Poa pratensis*..... ..... .***Chrysothamnus viscidiflorus / Poa pratensis* Semi-natural Shrub Herbaceous Vegetation [Provisional]**

17 *Chrysothamnus viscidiflorus* does not dominate.

18 *Ericameria nauseosa* dominates the shrub layer.

19 Other shrubs may present may include *Rhus trilobata* and *Artemisia tridentata. Bromus tectorum* is a major component of the herbaceous understory of this vegetation association. ....***Ericameria nauseosa / Bromus tectorum* Semi-natural Shrubland**

19 Other vegetation is sparse but usually includes *Eriogonum corymbosum, Gilia congesta, Yucca utahensis,* and *Gutierrezia sarothrae* on steep slopes where rock avalanches and severe erosion has occurred. .....***Ericameria nauseosa* Sand Deposit Sparse Vegetation**

18 *Ericameria nauseosa* does not dominate.

20 *Tetradymia canescens* dominates mixed shrub layer. Characteristic shrub species in mix are *Ephedra viridis, Quercus gambelii, Amelanchier utahensis, Artemisia tridentata* and *Ericameria nauseosa***.** .... ***Tetradymia canescens – Ephedra viridis* Shrubland [Provisional]**

20 *Purshia stansburiana* and *Arctostaphylos patula* codominate shrub layer. Mostly found on high mesa tops.. ..... ***Purshia stansburiana – Arctostaphylos patula* Shrubland [Provisional]**

Key F: Herbaceous Vegetation - Graminoids

1 *Poa pratensis* dominates meadow with cover of 10 to 80%. Other graminoids that may be present are *Bromus inermis, Elymus elymoides, Achnatherum lettermanii,* and *Elymus lanceolatus.* ....***Poa pratensis* Semi-natural Seasonally Flooded Herbaceous Alliance**

1 *Poa pratensis* may be present but is not dominant.

2 *Thinopyrum intermedium* is dominant in high-elevation dry meadows with cover of 60 to 80%. Other species commonly present are *Bromus inermis, Achnatherum lettermanii, Artemisia ludoviciana, Vicia americana,* and *Mertensia arizonica*. ..... ***Thinopyrum intermedium*** **Semi-natural Herbaceous Vegetation**

2 *Thinopyrum intermedium* is not present.

3 *Bromus inermis* is the dominant graminoid in intermittently flooded meadows with 50 to 90% cover. *Pascopyrum smithii* is commonly present. ..... ***Bromus inermis – (Pascopyrum smithii)*** **Semi-natural Herbaceous Vegetation**

3 *Bromus inermis* is not present.

4 *Hesperostipa comata* dominates small grasslands of plateaus in woodland or shrubland openings with cover of 10 to 50%..... ***Hesperostipa comata*** **Great Basin Herbaceous Vegetation**

4 *Hesperostipa comata* does not dominate but may be present or co-dominant.

5 *Hesperostipa comata* and *Bouteloua gracilis* codominate grasses of grassland/shrubland mosaic. Shrubs are present, but with less than 10% total cover, and can include *Ericameria nauseosa, Arctostaphylos patula, Artemisia tridentata, Quercus gambelii* and *Yucca elata* var. *utahensis* ..... ***Bouteloua gracilis – Hesperostipa comata*** **Herbaceous Vegetation [Provisional]**

5 *Hesperostipa comata* is not present.

6 *Muhlenbergia pungens* or *Muhlenbergia montana* is present in sparsely vegetated sands and is co-dominant with *Heterotheca villosa*. ..... ***Muhlenbergia (pungens, montana) – Heterotheca villosa*** **Herbaceous Vegetation [Provisional]**

6 *Muhlenbergia pungens,*or *M. montana* and *Heterotheca villosa* do not dominate vegetation association.

7 *Bromus tectorum* dominates floodplains and mesas with nearly 100% cover. ..... ***Bromus tectorum*** **Semi-natural Herbaceous Alliance**

7 *Bromus tectorum* is usually present, but does not dominate.

8 *Pleuraphis jamesii* dominates, greater than 10% cover, in low-elevation Pinyon-Juniper Woodland openings. *Gutierrezia* spp., *Opuntia* spp., and *Bromus tectorum* are commonly present. ..... ***Pleuraphis jamesii*** **Herbaceous Vegetation**

8 *Sporobolus cryptandrus* dominates the grassland of alluvial terraces with 10 to 20% cover. *Bromus tectorum, Bromus rigidus,* and *Pleuraphis jamesii* are commonly present. ..... ***Sporobolus cryptandrus*** **Great Basin Herbaceous Vegetation**

Key G: Herbaceous Vegetation – Palustrine

1 *Equisetum* spp. dominates streambank or stream channel vegetation ..... ***Equisetum (arvense, variegatum)* Herbaceous Vegetation**

1 *Equisetum* spp. does not dominate wetland vegetation

2 *Carex utriculata* dominates wetland vegetation with 80% cover..... ..... ***Carex utriculata* Herbaceous Vegetation**

2 *Carex utriculata* does not dominate wetland vegetation.

3 *Carex nebrascensis* forms homogeneous stands of 80% cover or dominates heterogeneous wetlands with at least 10% cover. .....***Carex nebrascensis* Herbaceous Vegetation**

3 *Juncus* balticus dominates, with cover of 70 to 90% and few other species are present or it has at least 10% cover in heterogeneous mesic graminoid stand. ....***Juncus balticus* Herbaceous Vegetation**

Key H: Forest and Woodland Plant Associations – Pines and Junipers

H1 – *Pinus ponderosa* dominates canopy layer; other species can be present but do not attain as much cover as Ponderosa pine.

H2 – *Pinus edulis* and *Juniperus osteosperma* dominate canopy layer, together having higher cover than other pine or juniper species.

H3 - *Pinus monophylla* and *Juniperus osteosperma* dominate canopy layer, together having higher cover than other pine or juniper species.

H4 – *Juniperus osteosperma* or *Juniperus scopulorum* dominate canopy layer; species of pine have little to no cover.

H1 – *Pinus ponderosa*

1 *Pinus ponderosa* is the dominant tree species with 20% to 60% cover.

2 In this open canopy woodland, *Arctostaphylos patula* dominates the shrub layer with at least 10% cover. A combination of shrubs present or even co-dominant in the association are *Arctostaphylos pungens, Amelanchier utahensis, Quercus gambelii, Quercus turbinella, Cercocarpus montanus, Cercocarpus intricatus*, and *Purshia tridentata*. This association occurs mostly in slickrock basins where sandy soils collect at elevations above 5800 feet. Occasionally, it will be found in gentle drainages on plateaus with low shrub cover and high herbaceous cover. .....***Pinus ponderosa / Arctostaphylos patula* Woodland**

2 *Arctostaphylos patula* may be present, but is not dominant in the shrub layer.

3 *Quercus gambelii* is dominant in the shrub layer and has at least 10% cover and heights of 1 to 3 meters. Other shrubs present may include *Amelanchier utahensis, Arctostaphylos patula, Purshia tridentata, Symphoricarpos oreophilus, Artemisia tridentata* and dwarf-shrubs*, Mahonia repens* and *Artemisia nova*. In some cases, *Pinus edulis* is present with tall

shrub *Quercus gambelii* in the subcanopy. *Juniperus scopulorum* is present in ravine environments. (If *Acer grandidentatum* has significant cover in sub-canopy, see Deciduous Vegetation Key) ..... ***Pinus ponderosa / Quercus gambelii*** **Woodland**

3 *Quercus gambelii* may be present, but is not dominant.

4 *Pinus ponderosa* is sparse with 10 to 30% cover and the dwarf-shrub, *Artemisia nova*, is dominant in the shrub layer with 10% to 20% cover. Islands of *Quercus gambelii* may be scattered amongst the dwarf-shrubs with equal or less cover. Herbaceous species typically present are *Carex rossii*, *Elymus elymoides*, *Poa secunda*. ....***Pinus ponderosa / Artemisia nova*** **Woodland**

4 *Artemisia nova* is not present or dominant.

5 *Pinus ponderosa* has a closed canopy, 60 to 100% cover in this mesic environment with somewhat organic soils. The understory is dominated by *Pteridium aquilinum*. ..... ***Pinus ponderosa / Pteridium aquilinum*** **Woodland [Provisional]**

5 *Pinus ponderosa* has an open canopy, 25 to 60% cover, in a mesic environment. The understory is dominated by *Bromus inermis,* not *Pteridium aquilinum. Poa pratensis* may be present to well represented..... .....***Pinus ponderosa / Bromus inermis*** **Semi-natural Woodland**

H2 – *Pinus edulis – Juniperus osteosperma*

1 *Pinus edulis* and *Juniperus osteosperma* make up the dominant strata with 20 to 60% combined cover *Pinus edulis* is most common on the eastern side of the Park.

2 Shrub layer is dominated by *Arctostaphylos patula*, 5 to 30% cover. *Amelanchier utahensis* and *Quercus gambelii* are present, but do not dominate. ....***Pinus edulis – Juniperus osteosperma / Arctostaphylos patula*** **Woodland**

2 *Arctostaphylos patula* may be present, but is not the dominant shrub.

3 *Cercocarpus montanus* characterizes this association. It must have at least 10% cover. *Amelanchier utahensis* is typically present and may codominate. *Quercus gambelii* may also be present. .....***Pinus edulis – Juniperus spp. / Cercocarpus montanus*** **Woodland**

3 *Cercocarpus montanus* does not dominate the shrub layer.

4 Shrub layer is dominated by *Quercus gambelii*. Cover may be low, but always exceeds cover of associated shrubs, *Cercocarpus montanus* and *Arctostaphylos patula*..... .....***Pinus edulis – Juniperus spp. / Quercus gambelii*** **Woodland**

4 *Quercus gambelii* does not dominate in the shrub layer.

5 Shrub layer is dominated by *Artemisia tridentata*. Cover may be only 5 to 15%. Other shrubs typically present are *Ephedra viridis* and *Amelanchier utahensis*..... .....***Pinus edulis – Juniperus spp. / Artemisia tridentata*** **Woodland.**

5 *Artemisia tridentata* does not dominate shrub layer.

6 Shrub layer is dominated by *Purshia stansburiana*. Other shrubs present or that codominate are *Amelanchier utahensis* and *Arctostaphylos patula*. .... ***Pinus edulis – Juniperus osteosperma / Purshia stansburiana*** **Woodland.**

6 *Purshia stansburiana* does not dominate the shrub layer

7 Shrub layer is dominated by *Cercocarpus intricatus* on steep slickrock slopes. *Amelanchier utahensis* and *Quercus gambelii* are usually present across and may codominate. .... ***Pinus edulis – Juniperus osteosperma / Cercocarpus intricatus*** **Woodland.**

7 Shrub layer is dominated by *Cercocarpus ledifolius*. Though considered a shrub, *Cercocarpus ledifolius* may occur in robust tree form. It is accompanied by *Cercocarpus montanus, Amelanchier utahensis, Arctostaphylos patula* and *Quercus gambelii*. This association is restricted to the northern boundary of Zion NP at high elevations .....***Pinus edulis / Cercocarpus ledifolius*** **Woodland [Provisional].**

H3 – *Pinus monophylla – Juniperus osteosperma*

1 *Pinus monophylla* and *Juniperus osteosperma* make up the dominant strata with 20 to 60% combined cover. *Pinus monophylla* is of lower elevations and mostly occurs in the western side of Zion NP.

2 *Shepherdia rotundifolia* has greater than 5% cover. *Amelanchier utahensis* is usually present and codominant. Other shrubs typically present are *Quercus turbinella, Rhus trilobata,* and *Fraxinus anomala.* ..... ***Pinus monophylla – Juniperus osteosperma / (Shepherdia rotundifolia – Amelanchier utahenis)*** **Woodland**

2 *Shepherdia rotundifolia* is not present or contributes less than 5% cover.

3 Shrub layer is dominated by *Quercus turbinella* with cover greater than 5%. Other shrubs commonly present are *Amelanchier utahensis, Quercus gambelii, Cercocarpus montanus, Arctostaphylos patula, Purshia* spp. and *Fraxinus anomala.* .... ***Pinus monophylla – Juniperus osteosperma / Quercus turbinella*** **Woodland**

3 *Quercus turbinella* is not dominant, has less than 5% cover, or is a small component of dominant herbaceous understory.

4 Shrub layer is a mixture of *Cercocarpus montanus, Quercus gambelii,* and/or *Amelanchier utahenis. Quercus turbinella* is absent and other shrubs are insignificant. ..... ***Pinus monophylla – Juniperus osteosperma / Cercocarpus montanus – Quercus gambelii*** **Woodland [Provisional]**

4 *Cercocarpus montanus, Quercus gambelii,* and/or *Amelanchier utahensis* do not codominate the shrub layer.

5 Shrub layer is dominated by *Artemisia tridentata*, cover usually less than 20%. *Amelanchier utahensis* may be present to abundant. ..... ***Pinus monophylla – Juniperus osteosperma / Artemisia tridentata*** **Woodland**

5 Shrub layer is not dominated by *Artemisia tridentata*

6 *Coleogyne ramosissima* is present in the shrub layer and accompanied by *Artemisia tridentata* and *Ephedra nevadensis*. ..... ***Pinus monophylla – Juniperus osteosperma / Coleogyne ramosissima*** **Woodland [Provisional]**

6 *Coleogyne ramosissima* is not present.

7 *Artemisia nova* and *Gutierrezia sarothrae* constitute the shrub layer. ..... ***Pinus monophylla – Juniperus osteosperma / Artemisia nova*** **Woodland.**

7 Shrub stratum is absent or insignificant in comparison to herbaceous vegetation layer.

8 *Hesperostipa comata* dominates the herbaceous understory and shrub cover is less than 10%..... ***Pinus monophylla – Juniperus osteosperma / Hesperostipa comata*** **Woodland**

8 *Hesperostipa comata* does not dominate the understory.

9 *Pleuraphis jamesii* dominates the herbaceous layer with greater than 10% cover. *Gutierrezia sarothrae* is also present with greater than 10% cover.. ***Pinus monophylla – Juniperus osteosperma / Gutierrezia sarothrae / Pleuraphis jamesii*** **Woodland [Provisional]**

9 Dwarf shrubs present are *Gutierrezia sarothrae* and *Opuntia* spp. and contribute less than 10% cover. Herbaceous layer is insignificant. ..... ***Pinus monophylla – Juniperus osteosperma*** **/ Sparse Understory Woodland**

H4 – *Juniperus osteosperma* or *Juniperus scopulorum*

1 *Juniperus osteosperma* is present, 20 to 30% cover, but is not associated with *Pinus monophylla*. Elevations are below 4000 feet. *Artemisia tridentata* clearly dominates the shrub layer. ..... ***Juniperus osteosperma / Artemisia tridentata*** **Woodland**

1 *Juniperus scopulorum* and *Quercus gambelii* dominate the canopy layer. Commonly occurs in gentle to moderate drainages and on slopes in northern regions of the park. *Juniperus osteosperma, Pinus monophylla*, and *Pinus edulis* may be present, but do not contribute significant cover. ..... ***Juniperus scopulorum - Quercus gambelii*** **Woodland [Provisional]**

Key I: Forest and Woodland Plant Associations: Douglas-fir & White fir

1 *Abies concolor* is present to abundant in the forest canopy. *Pseudotsuga menziesii* and *Pinus ponderosa* may also be present, dominate and/or codominate these vegetation associations.

2 *Arctostaphylos patula* is present in the shrub layer. This association occurs at elevations above 7500 feet and is uncommon in Zion. ..... ***Abies concolor / Arctostaphylos patula*** **Forest**

2 *Arctostaphylos patula* is not present.

3 *Quercus gambelii* dominates the shrub layer and is usually present in the sub-canopy as a tall shrub or tree. *Abies concolor* dominates the tree canopy or is codominant with *Pseudotsuga menziesii, Pinus ponderosa,* and/or *Juniperus scopulorum. Acer grandidentatum* is absent. Other species likely to contribute cover in the shrub layer are *Amelanchier utahensis* and *Symphoricarpos oreophilus*..... ***Abies concolor / Quercus gambelii*** **Forest**

3 *Quercus gambelii* is not dominant in the sub-canopy or shrub layer.

4 *Acer grandidentatum* is present to abundant in the sub-canopy. *Quercus gambelii*, *Acer negundo,* and *Pseudotsuga menziesii* may also contribute to sub-canopy cover in ravines at lower elevation. ..... ***Abies concolor / Acer grandidentatum*** **Forest**

4 *Acer grandidentatum* is not dominant in the sub-canopy or shrub layer.

5 *Abies concolor* dominates the canopy and *Symphoricarpos oreophilus* dominates the understory. Other shrubs that may be present are *Amelanchier utahensis, Amelanchier alnifolia, Prunus virginiana,* and *Quercus gambelii*..... ***Abies concolor / Symphoricarpos oreophilus*** **Forest**

5 *Symphoricarpos oreophilus* does not dominate the shrub layer and *Abies concolor* is not present or does not dominate.

1 *Pseudotsuga menziesii* dominates the tree canopy, but *Abies concolor* is not present. *Acer grandidentatum* or *Quercus gambelii* can be abundant.

6 *Quercus gambelii* dominates the sub-canopy, and also the shrub layer. ..... ***Pseudotsuga menziesii / Quercus gambelii Forest***

6 *Quercus gambelii* is not dominant in the sub-canopy or shrub layer.

7 *Acer grandidentatum* is present to abundant in the canopy or sub-canopy. *Quercus gambelii*, and *Acer negundo* may also contribute to sub-canopy cover ..... ***Pseudotsuga menziesii / Acer grandidentatum*** **Forest**

7 *Symphoricarpos oreophilus* and *Amelanchier utahensis* dominate the understory. ..... ***Pseudotsuga menziesii / Symphoricarpos oreophilus*** **Forest**

Key J: Forested Vegetation—Deciduous

1 The association occurs in riparian ecosystems including abandoned floodplains. *Populus fremontii* is present and dominant in the canopy layer.

2 Mature and young growth *Populus fremontii* dominate the banks of perennial streams. *Fraxinus velutina* and *Acer negundo* may occur in the sub-canopy. *Baccharis emoryi* is the dominant riparian shrub. ..... ***Populus fremontii / Baccharis emoryi* Woodland [Provisional]**

2 *Baccharis emoryi* is not the dominant riparian shrub in the understory.

3 S*alix exigua* is the dominant riparian shrub under *Populus fremontii* canopy. .... ***Populus fremontii / Salix exigua* Woodland**

3 *Salix exigua* is not the dominant shrub.

4 *Betula occidentalis* is dominant in the understory, or is mixed with small individuals of tree species. Tree species include *Populus fremontii, Populus angustifolia, Fraxinus velutina, Acer negundo*, *Pinus ponderosa,* and *Juniperus scopulorum*. Individual trees are young and included in tall shrub layer. Occasionally, mature individuals provide 20 to 40% cover. *Acer grandidentatum* and *Quercus gambelii* are often present in the shrub layer. .... ***Populus fremontii / Betula occidentalis* Wooded Shrubland**

4 *Betula occidentalis* is not the dominant shrub.

5 Mature *Populus fremontii* dominates riparian zone. *Fraxinus velutina* and *Acer negundo* are present in the canopy or sub-canopy. *Baccharis emoryi* or *Salix exigua* are **not** major components of the understory. Where the association occurs on the alluvial floodplain of the Park, the understory is highly disturbed and dominated by *Bromus tectorum* and *Bromus rigidus*. This association may also occur in less disturbed areas, low-elevation side canyons. In these situations, the association has more complex layers and species diversity, but with the same dominant components. .... ***Populus fremontii – Fraxinus velutina* Woodland**

5 *Populus fremontii* is not the dominant tree in the canopy.

6 *Acer negundo* is dominant in the canopy of alluvial terraces. Herbaceous understory includes *Bromus tectorum* and *Bromus rigidus*. Shrubs may include *Ericameria nauseosus, Prunus virginiana*, and *Quercus gambelii.* .... ***Acer negundo* / Disturbed Understory Woodland [Provisional]**

6 *Acer negundo* is dominant in the canopy and *Brickellia grandiflora* is the dominant understory species. .... ***Acer negundo / Brickellia grandiflora* Woodland [Provisional]**

1 The association does not occur in riparian zones, but exists in mesic or high-elevation environments.

7 Short woodland dominated by *Fraxinus anomala*, and associated with steep rocky ravines or seeps on colluvial slopes. Other species typically present are *Amelanchier alnifolia, Rhus trilobata,* and *Ericameria nauseosa*. ..... ***Fraxinus anomala* Woodland**

7 *Fraxinus anomala* is not present or has very low cover.

8 *Populus tremuloides* is present to abundant and codominant with *Abies concol*or in the canopy. *Symphoricarpos oreophilus* dominates the shrub layer..... .....***Populus tremuloides – Abies concolor / Symphoricarpos oreophilus*** **Forest**

8 *Populus tremuloides* and *Abies concolor* codominate, but *Symphoricarpos oreophilus* is not a major component of the understory.

9 *Poa pratensis* dominates the understory..... ..... ***Populus tremuloides – Abies concolor / Poa pratensis*** **Semi-natural Forest**

9 *Poa pratensis* is not dominant in the understory.

10 *Abies concolor* is not present and *Populus tremuloides* is the dominant species in the canopy. *Quercus gambelii* is present (sometimes in the tree canopy) with typical heights of 1 to 3 meters; *Symphoricarpos oreophilus* is co-dominant in the shrub layer, and up to one meter in height..... ***Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus*** **Forest**

10 *Quercus gambelii* is absent or insignificant in shrub layer of *Populus tremuloides* Forest.

11 *Symphoricarpos oreophilus* dominates the shrub layer of *Populus tremuloides* Forest. ..... ***Populus tremuloides / Symphoricarpos oreophilus /*** **Tall Forbs Forest**

11 *Populus tremuloides* is not present. *Quercus gambelii* and *Acer grandidentatum* codominate the canopy, sub-canopy or shrub layer with total cover of 60 to 100%. This association may have an emergent tree canopy of *Pinus ponderosa* and *Juniperus scopulorum* (often occurs in shady ravines). If present, conifer canopy cover ranges from 10 to 30%. *Celtis reticulata* may be a major component of this woodland. ....***Acer grandidentatum / Quercus gambelii*** **Forest**